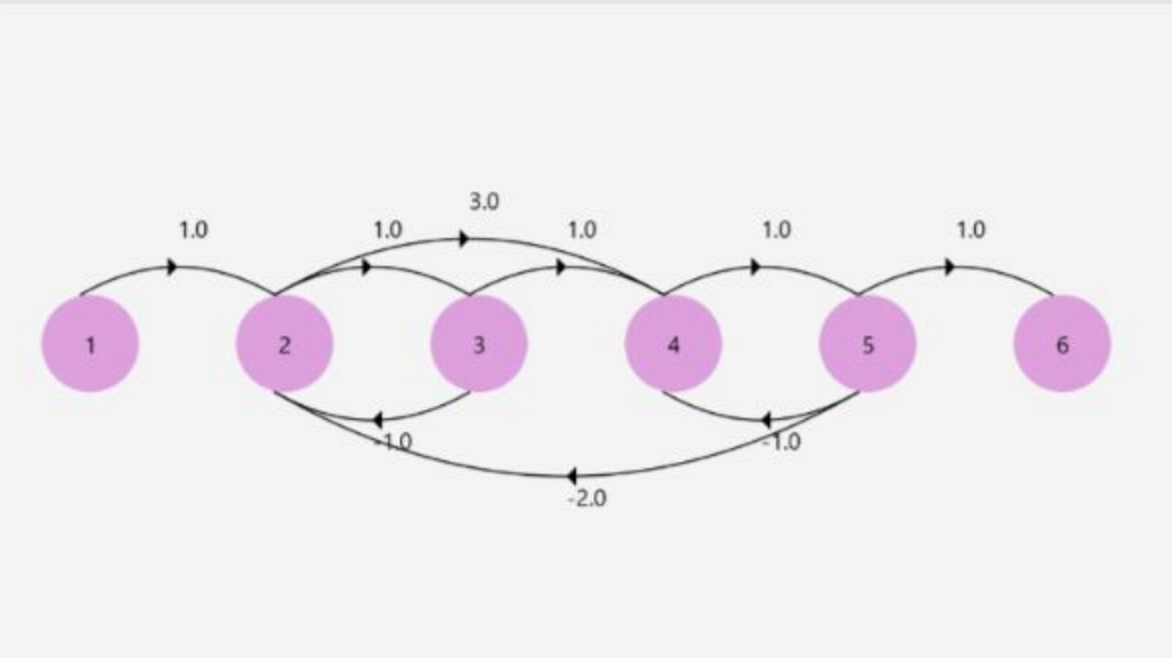
Linear control

Signal Flow Graph

Calculate overall gain of a graph using mason rule



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Source code : https://github.com/norhanmagdi/SFG

Content

Features :

This is a javafx program for calculate the overall gain of a graph using manson rule and contains the following features:

- ➔ Draw signal flow graph
- ➔ Finding forward paths and calculate their gain
- ➔ Finding loops and calculate their gain
- ➔ Finding non touching loops and calculate their gain
- ➔ Calculate delta
- ➔ Calculate deltas for each path
- ➔ Calculate overall gain

Data Structures & algorithms:

Graph:

Adjacency list is used to implement the graph manually such that each element of the list is Node consists of 2 values one for the node number and the other for weight of the path .

Storing data:

-ArrayList for storing paths and loops as num of (path/loop) is the key and the value is (path/loop)

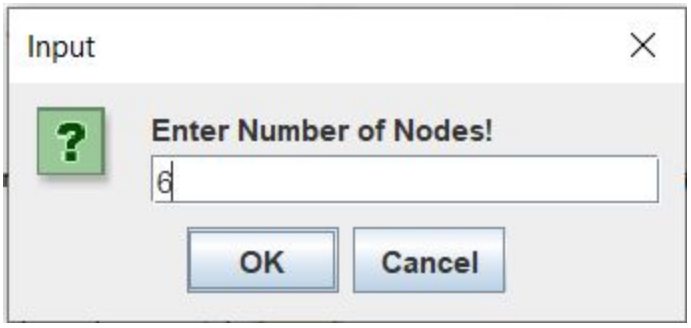
-HashMap for storing gain of paths and loops as num of (path/loop) is the key and the value is the gain of (path/loop)

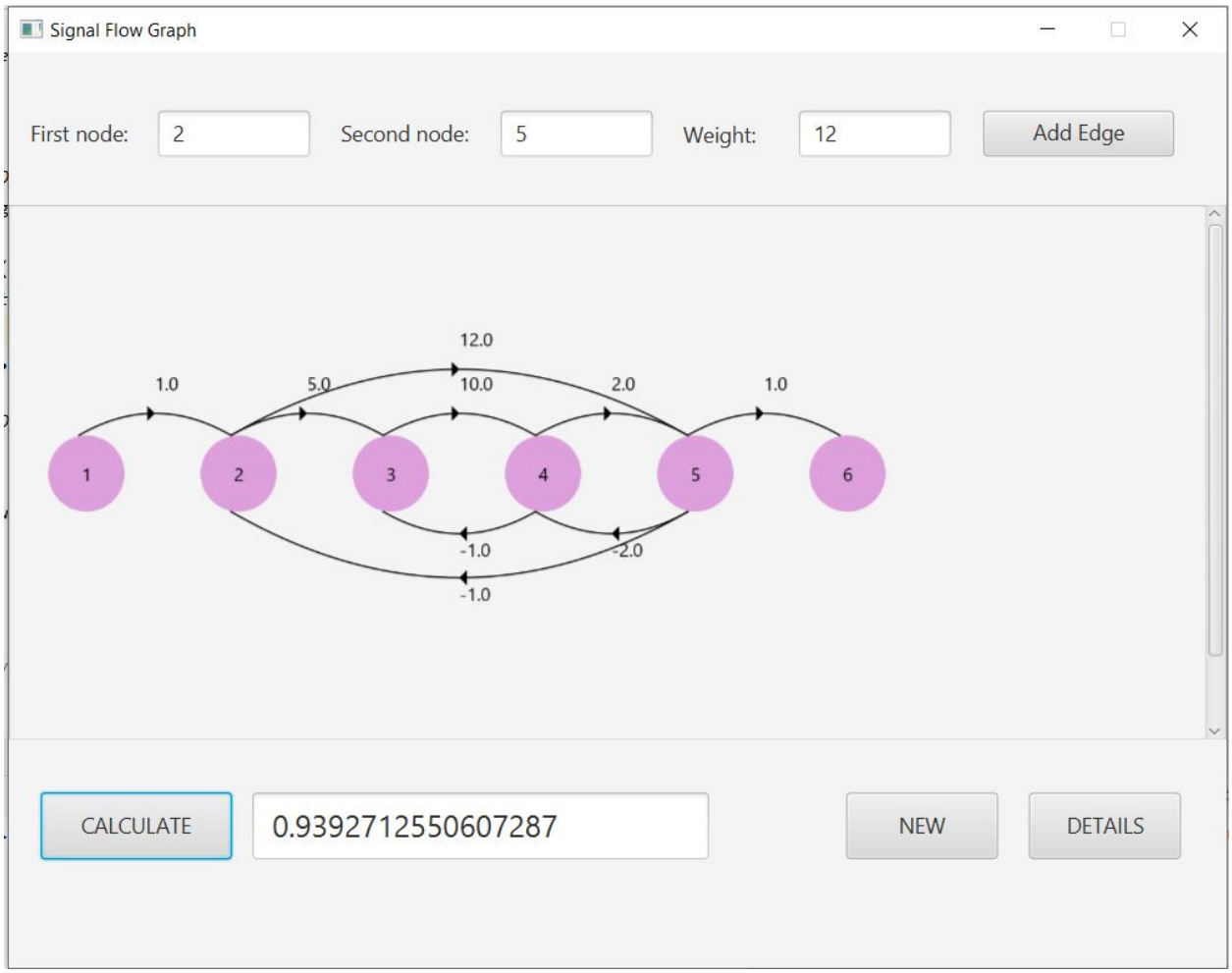
Algorithms used:

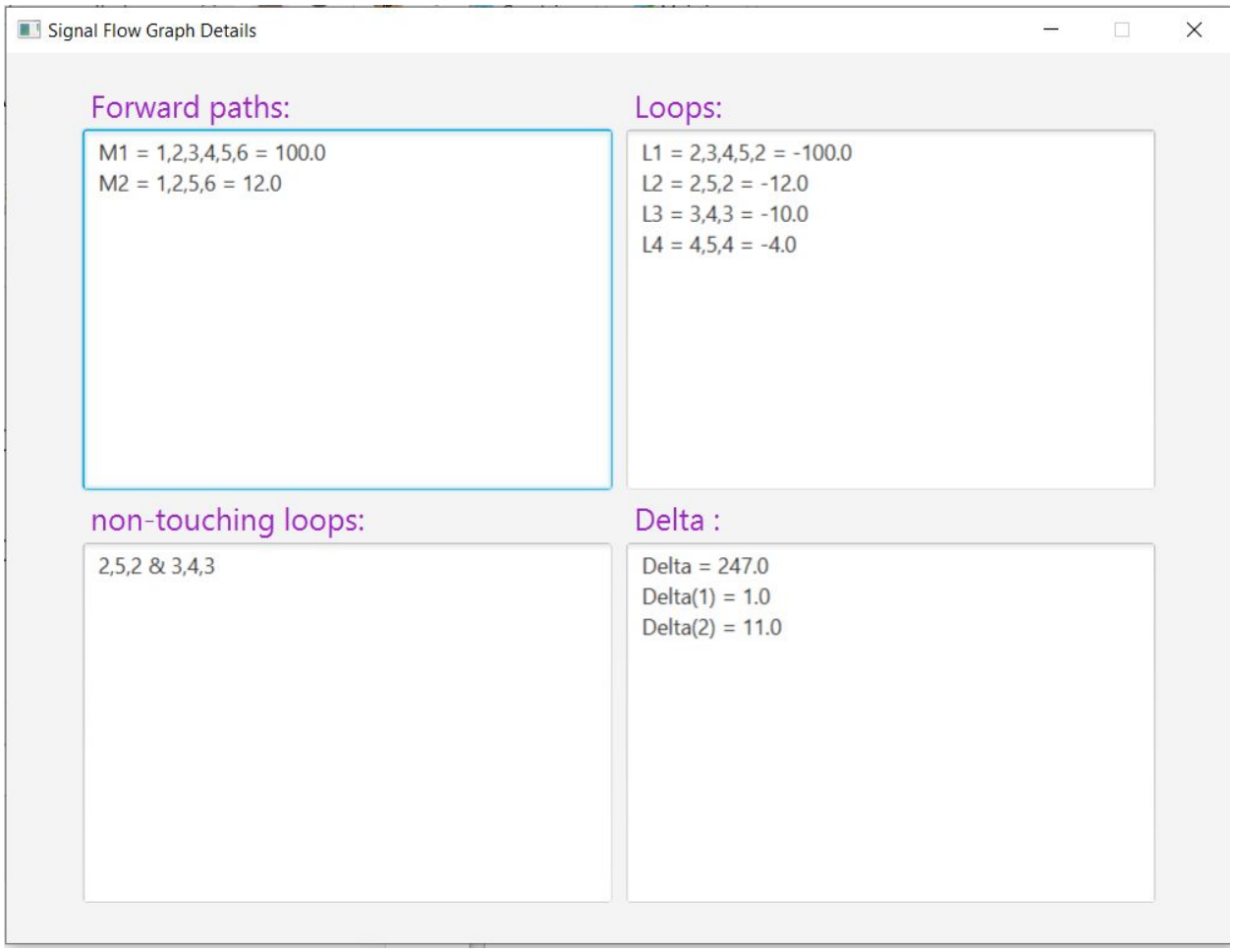
The main algorithm used is DFS (Depth First Search) to make sure that we reach target without passing the same node twice.

Sample run:

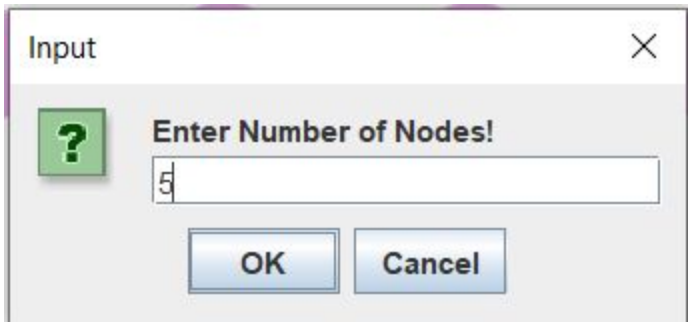
➔

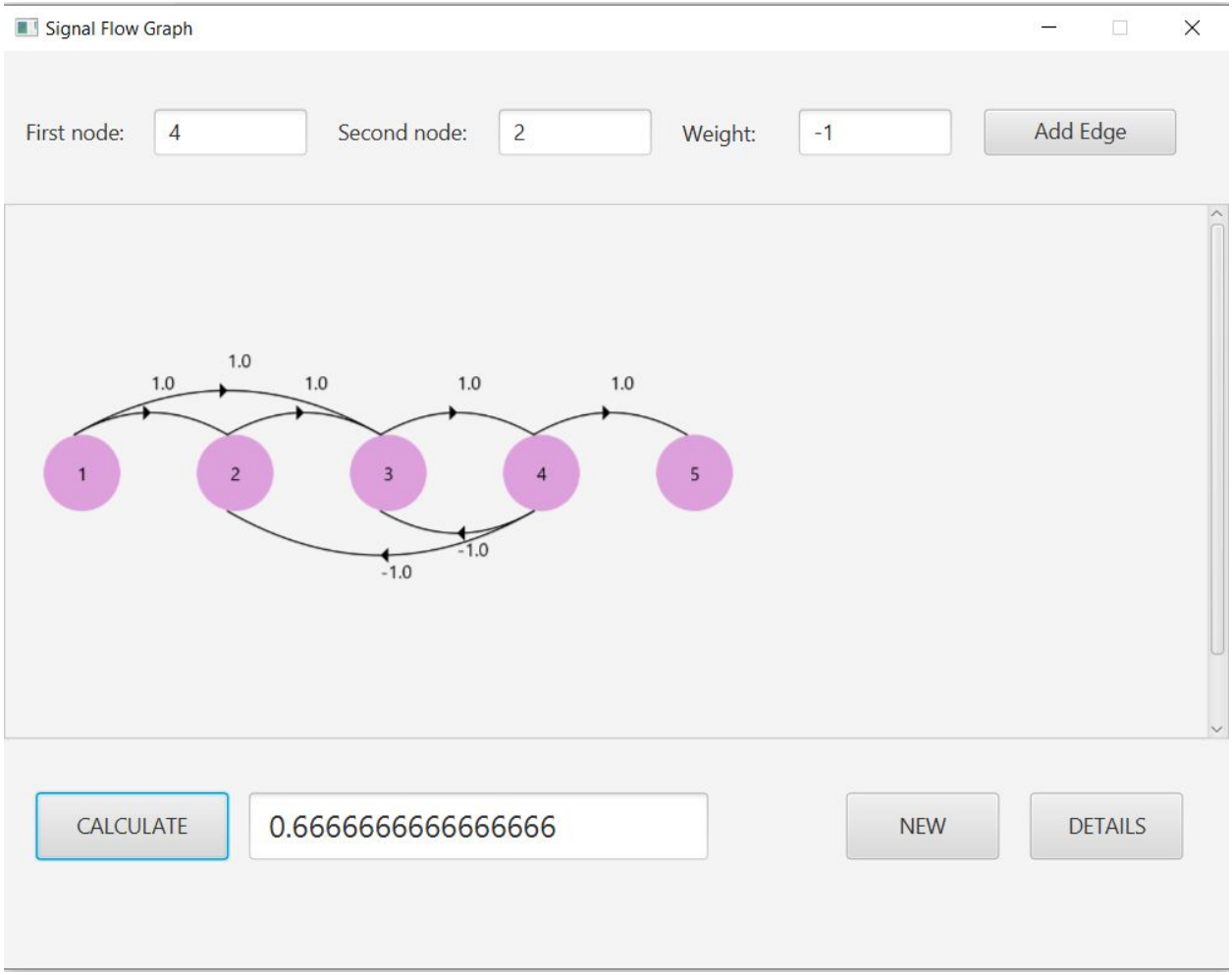

Input
Enter Number of Nodes!
6
OK
Cancel

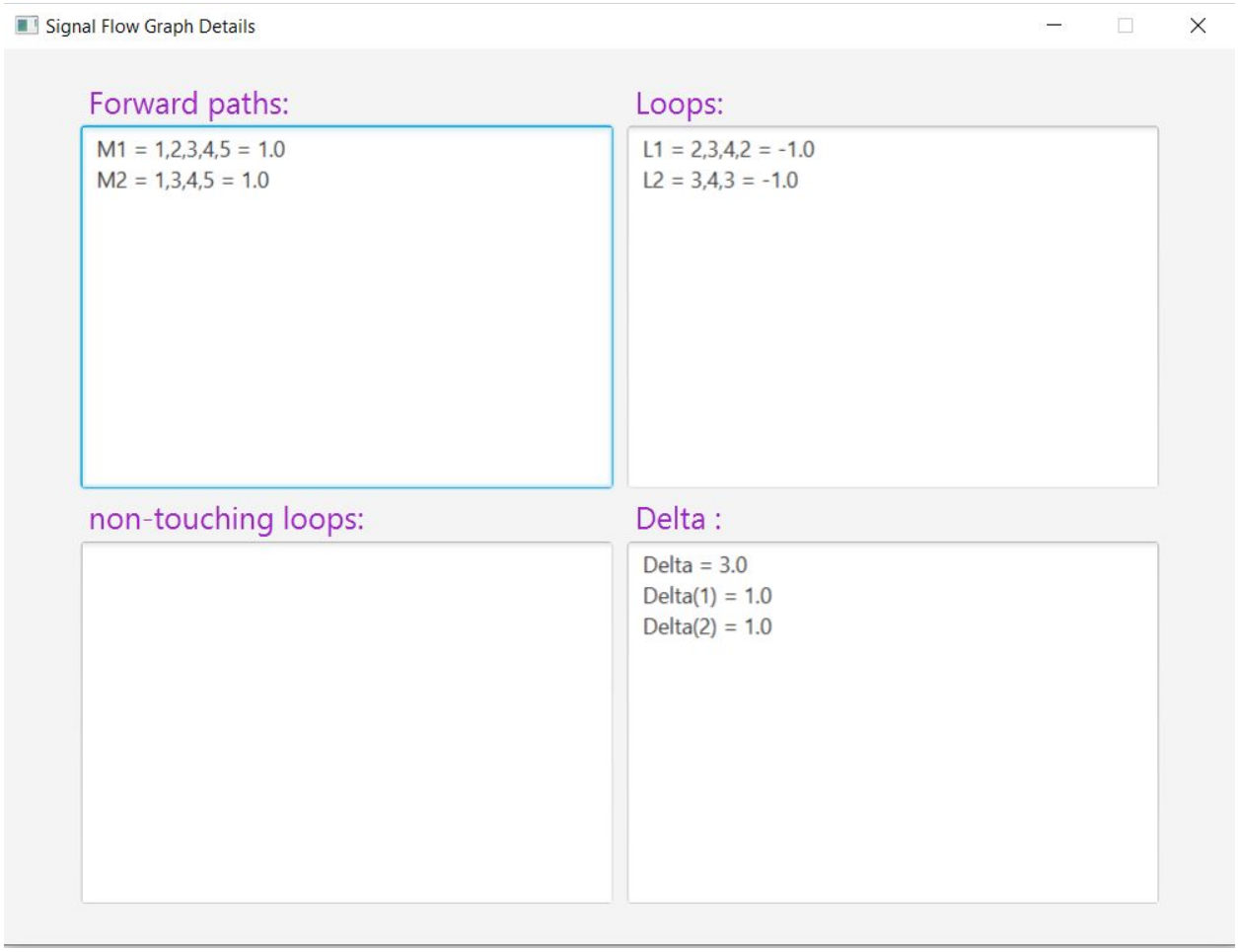

Signal Flow Graph
First node:
2
Second node:
5
Weight:
12
Add Edge
12.0
1.0
5.0
10.0
2.0
1.0
1
2
3
4
5
6
-1.0
-2.0
-1.0
CALCULATE
0.9392712550607287
NEW
DETAILS

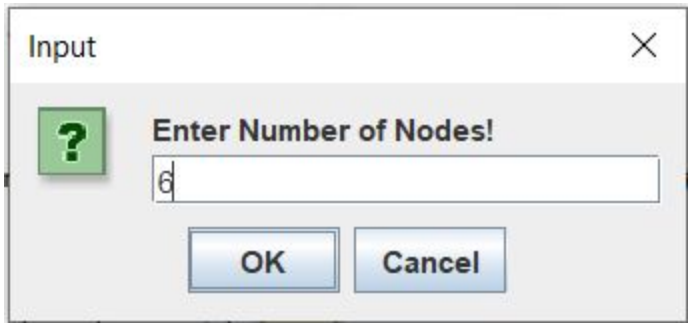

Signal Flow Graph Details
Forward paths:
M1 = 1,2,3,4,5,6 = 100.0
M2 = 1,2,5,6 = 12.0
Loops:
L1 = 2,3,4,5,2 = -100.0
L2 = 2,5,2 = -12.0
L3 = 3,4,3 = -10.0
L4 = 4,5,4 = -4.0
non-touching loops:
2,5,2 & 3,4,3
Delta :
Delta = 247.0
Delta(1) = 1.0
Delta(2) = 11.0

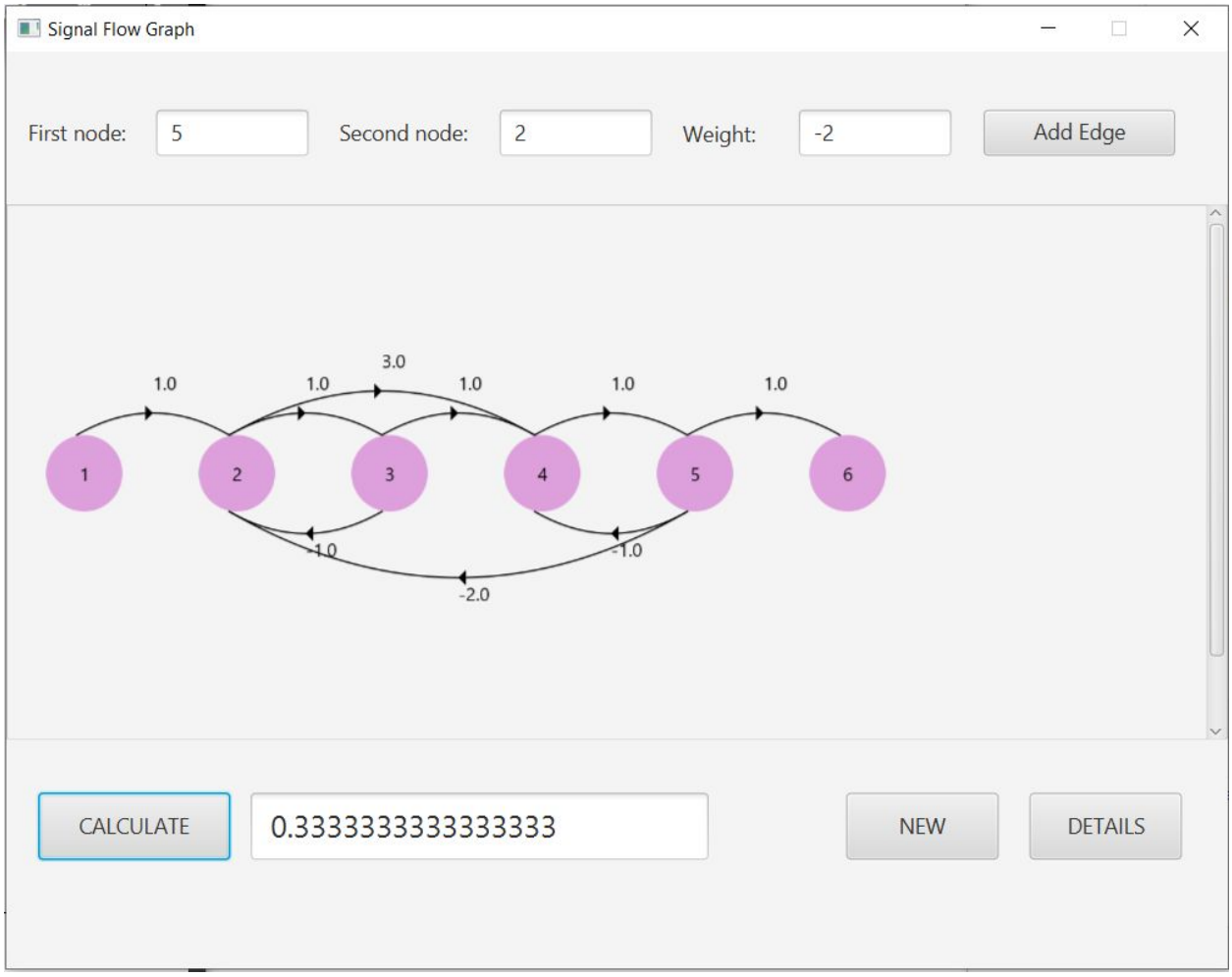
➔

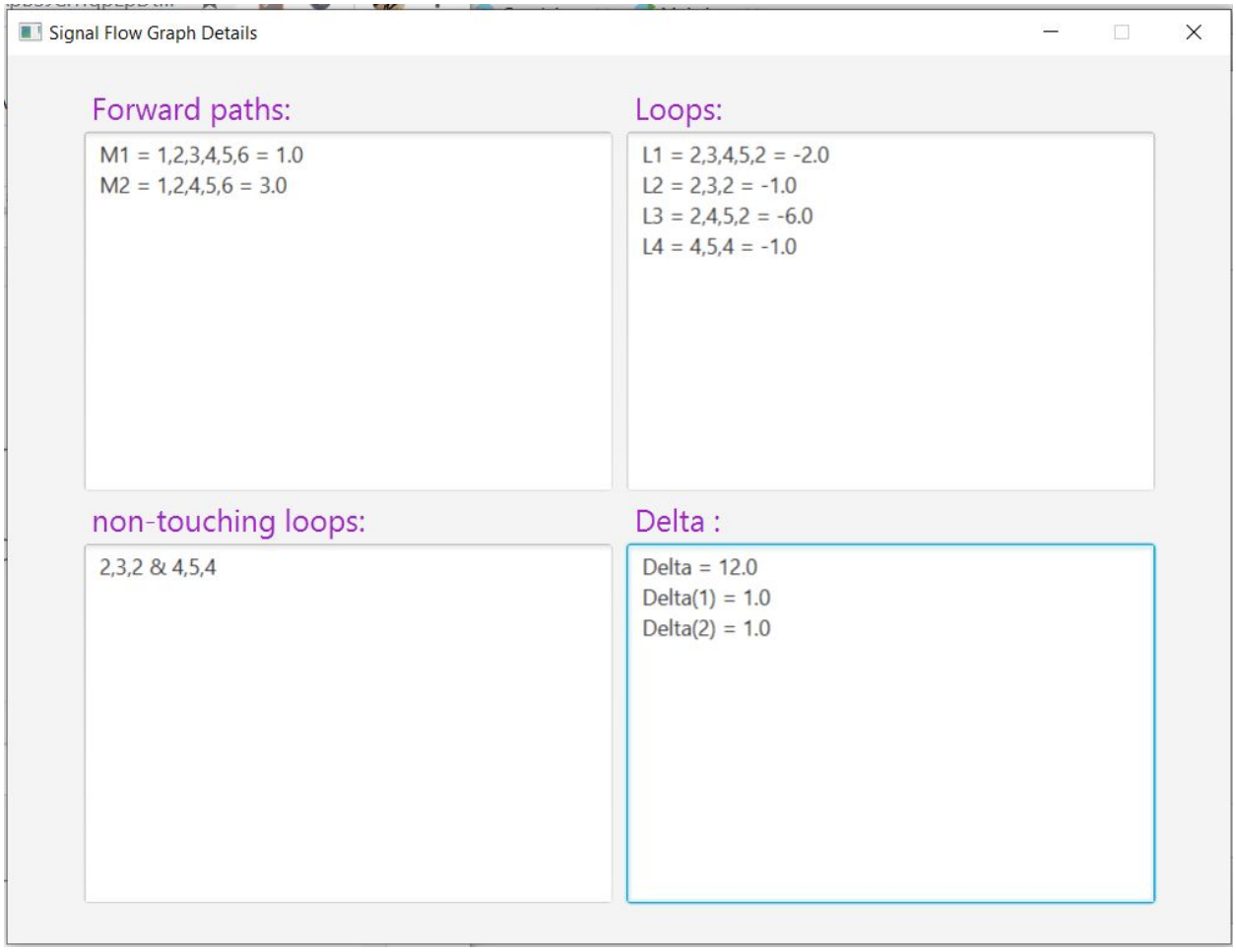

Input
Enter Number of Nodes!
5
OK
Cancel


Signal Flow Graph
First node:
4
Second node:
2
Weight:
-1
Add Edge
1.0
1.0
1.0
1.0
1.0
1
2
3
4
5
-1.0
-1.0
CALCULATE
0.6666666666666666
NEW
DETAILS


Signal Flow Graph Details
Forward paths:
M1 = 1,2,3,4,5 = 1.0
M2 = 1,3,4,5 = 1.0
Loops:
L1 = 2,3,4,2 = -1.0
L2 = 3,4,3 = -1.0
non-touching loops:
Delta :
Delta = 3.0
Delta(1) = 1.0
Delta(2) = 1.0

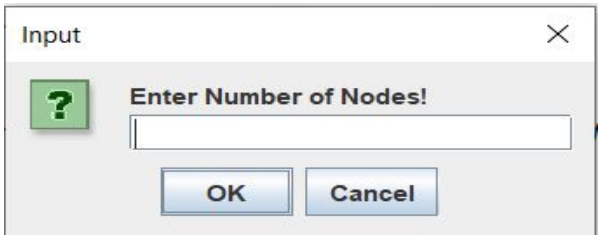

Input
Enter Number of Nodes!
6
OK
Cancel


Signal Flow Graph
First node:
5
Second node:
2
Weight:
-2
Add Edge
1.0
1.0
3.0
1.0
1.0
1.0
1
2
3
4
5
6
-1.0
-1.0
-2.0
CALCULATE
0.3333333333333333
NEW
DETAILS


Signal Flow Graph Details
Forward paths:
M1 = 1,2,3,4,5,6 = 1.0
M2 = 1,2,4,5,6 = 3.0
Loops:
L1 = 2,3,4,5,2 = -2.0
L2 = 2,3,2 = -1.0
L3 = 2,4,5,2 = -6.0
L4 = 4,5,4 = -1.0
non-touching loops:
2,3,2 & 4,5,4
Delta :
Delta = 12.0
Delta(1) = 1.0
Delta(2) = 1.0

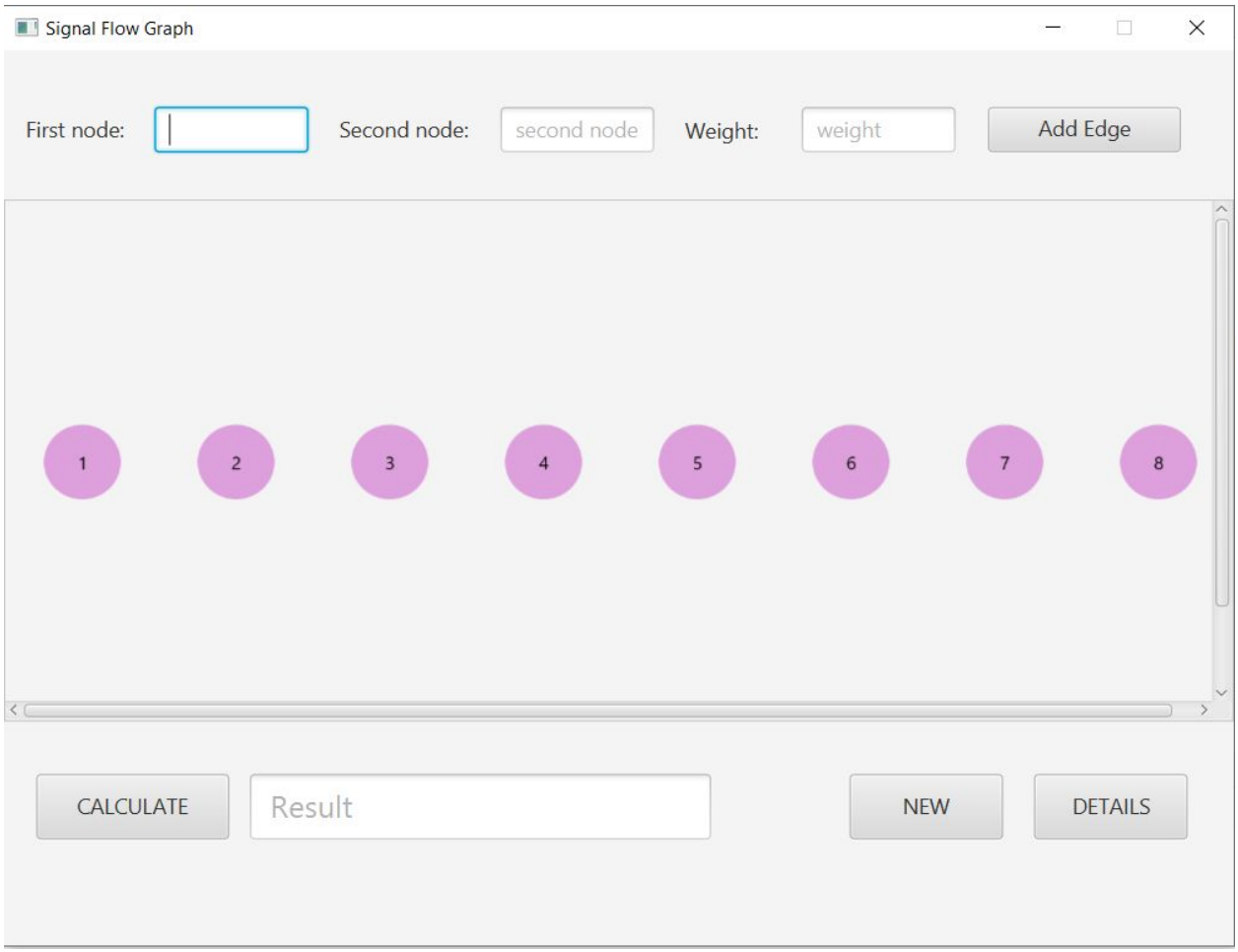
User guide:

First user choose number of nodes :



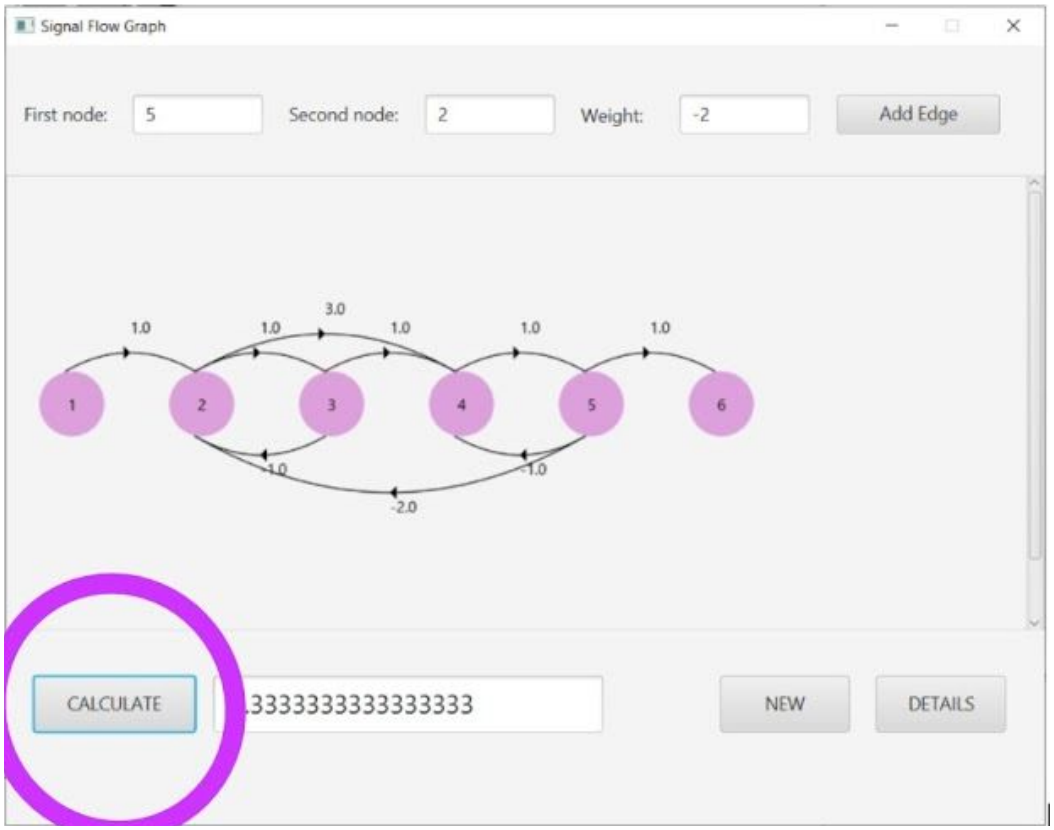
Then the nodes are drawn ,

To add edge : write the nodes and weight then click on ADD EDGE button

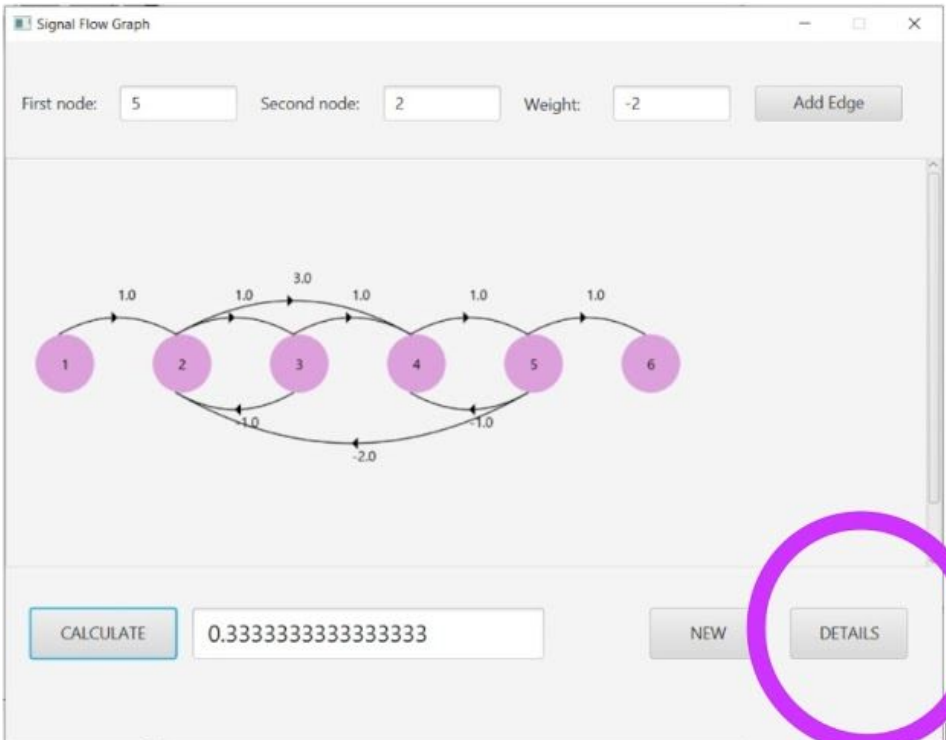


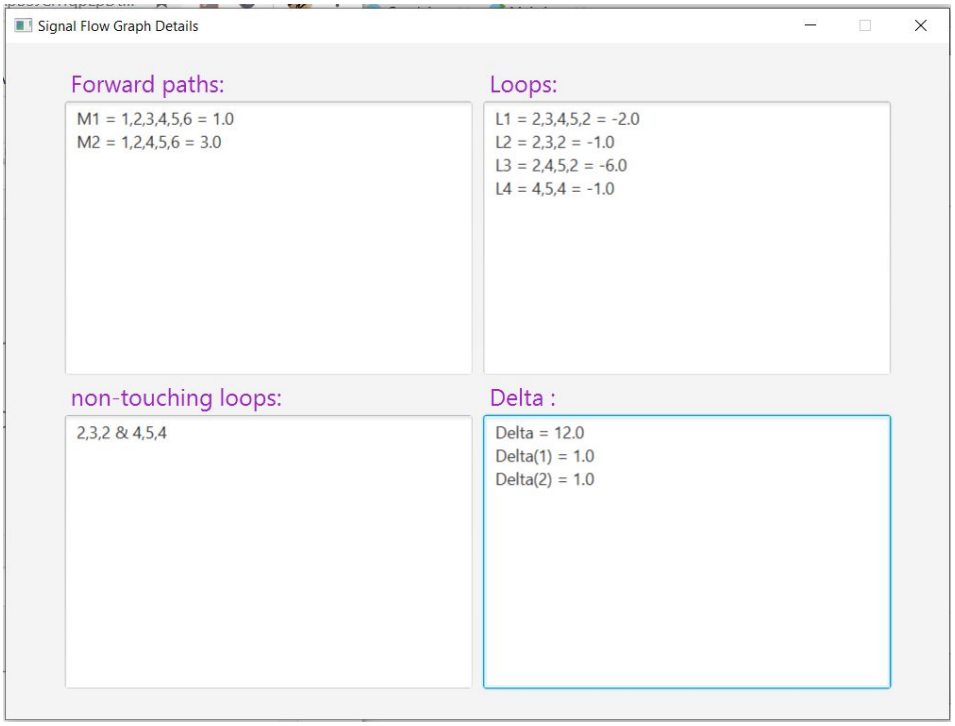
Then the edge is drawn,

After finishing drawing the graph to calculate overall gain click on CALCULATE button



After calculating overall gain to show the details (loops/paths/delta) click on DETAILS button





To start a new graph click on NEW button